PROM PROGRAMMER
Program Card Set
909/919-1512

025-1512 REV D APR 83

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SECTION 1
SPECIFICATIONS

1.1 INTRODUCTION

Data I/O Program Card Sets configure the programmer for the requirements of particular devices. This card set, used with the appropriate socket adapter, will program and read the devices listed in Table 1-1. New applications are developed frequently; therefore, consult the most recent Data I/O Comparison Chart of Programmable Devices to supplement Table 1-1.

Table 1-1. Applications of the Program Card Set

Array Size and Technology	PROM Part Number	Programmed Logic Level	Pinout	Socket Adapter
ADVANCED MICRO DEVICES				
2048x8 MOS	4716	VOL TS	24 PIN	1510
ELECTRONIC ARRAYS				
2048x8 MOS	2716	VOL TS	24 PIN	1510
FUJITSU				
2048x8 MOS	8516(2716)	VOL TS	24 PIN	1510
HITACHI				
2048x8 MOS	462716	VOL TS	24 PIN	1510
INTEL				
1024x8 MOS	2758	VOL TS	24 PIN	1366-4
1024x8 MOS	2758 S 1865	VOL TS	24 PIN	1366-3
2048x8 FL	2716/8716	VOL TS	24 PIN	1510
4096x8 MOS	2732	VOL TS	24 PIN	1531
MARUMAN INTEGRATED CIRCUITS				
2048x8 MOS	2716	VOL TS	24 PIN	1510
MITSUBISHI				
2048x8 MOS	2716	VOL TS	24 PIN	1510
MOSTEK				
2048x8 MOS	2716	VOL TS	24 PIN	1510
NATIONAL SEMICONDUCTOR				
2048x8 MOS	2716	VOL TS	24 PIN	1510
NIPPON ELECTRIC CO., LTD.				
2048x8 MOS	2716	VOL TS	24 PIN	1510
OKI				
2048x8 MOS	2716	VOL TS	24 PIN	1510
TEXAS INSTRUMENTS				
1024x8 MOS	2508	VOL TS	24 PIN	1366-4
2048x8 MOS	2516	VOL TS	24 PIN	1510
4096x8 MOS	2532	VOL TS	24 PIN	1511
8192x8 MOS	2564	VOL TS	28 PIN	1936
TOSHIBA				
2048x8 MOS	323	VOL TS	24 PIN	1510

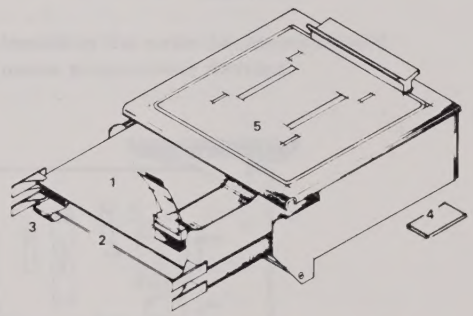
The Program Card Set includes the parts listed in Figure 1-1. The analog card produces the correct voltages in the proper waveforms for the device to be programmed or read. The digital card controls the sequences and shapes of these waveforms.

A Program Card Set for use in a System 17 or 19 Programmer is included in a Programming Pak and designated by a 919- part number. See Figure 1-1 a). A card set shipped alone, for use in a Model 1-5, 7 or 9 Programmer, bears a 909-part number. See Figure 1-1 b).

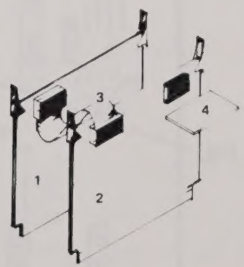
1.2 PROGRAMMING ALGORITHM

The 909/919-1512 Program Card Set is designed to program data at each address successfully before advancing to the next address. A single program pulse is applied to the device at each address as data levels appear on the bit lines representing the specific pattern to be programmed (parallel programming).

The Program Card Set also provides power and enable levels required for the duration of the program sequence. If any bit fails to program after a single attempt, the Program Card Set will abort the Program mode and halt machine operation (one pulse reject).



a) Programming Pak for System 17 and 19 Programmers



b) Program Card Set for Model 1-9 Programmers

1. DIGITAL CARD	701-1348
2. ANALOG CARD	701-1512
3. INTERCONNECT CABLE	709-1608
4. CALIB. PROGRAM ADAPTER	910-1512
5. PROGRAMMING PAK CARRIER	940-0919

Figure 1-1. Parts included in the a) Programming Pak b) Program Card Set

1.3 CALIBRATOR PROGRAM ADAPTER

The card set includes a Calibrator Program Adapter which mates with the Data I/O Universal Calibrator (P/N 910-1071). The PROMs on the adapter deliver the control signals to the analog card.

Using the calibrator and following the calibration procedure in Section 4 of this manual, Data I/O customers can be sure the Program Card Set remains within voltage and timing tolerances for effective programming.

1.4 CALIBRATION REQUIREMENTS

The need for calibration varies with the amount of use; calibration is recommended every ninety days of regular use or if programming yields fall below manufacturer's recommended minimums.

Complete calibration must be performed with a programmer that has an address and data display. Card sets for use in a Model 7 or System 17 may be properly calibrated using another Data I/O programmer. Alternately, Data I/O provides calibration service at regional Service Centers.

SECTION 2
INSTALLATION

2.1 DIGITAL CARD JUMPERS

Figure 2-1 shows the customer-selectable-jumper locations on the digital card. Refer to Table 2-1 to check the jumper positions. If a jumper change is ever made, be sure to replace the jumpers in the normal position before using the card set for programming.

Table 2-1. Customer-Selectable Digital Card Jumpers

JUMPER	FUNCTION	NORMAL POSITION	COMMENTS
JP1	Reject	A	One pulse reject
JP3	Word Limit	2048	Selection defaults to socket adapter
JP4	Word Width	8 bit	Selection defaults to socket adapter

2.2 CARD SET INSERTION

When changing card sets in Model 1-9 Programmers, turn power OFF.

Power may remain ON when changing Programming Paks in System 17 or 19 Programmers. In this way, data may be retained in RAM during the operation.

2.2.1 MODELS 1-5

Refer to Figure 2-2.

Remove the top cover from the programmer. Each card in the card cage has color-coded extractors which correspond to the colors of the card guides. Install the analog card in the white/white position in the card cage. Install the digital card in the front brown/orange position. Components of both cards must face forward in Model 3 and 5 Programmers and to the right in Model 1 and 2 Programmers. Insert the cable into the socket receptacle, route it over the card cage, and attach it to J2 on the analog card. Be sure the cable is oriented correctly: the red stripe must align with the connector dot.

CAUTION

Installing the cable backwards could cause programmer damage.

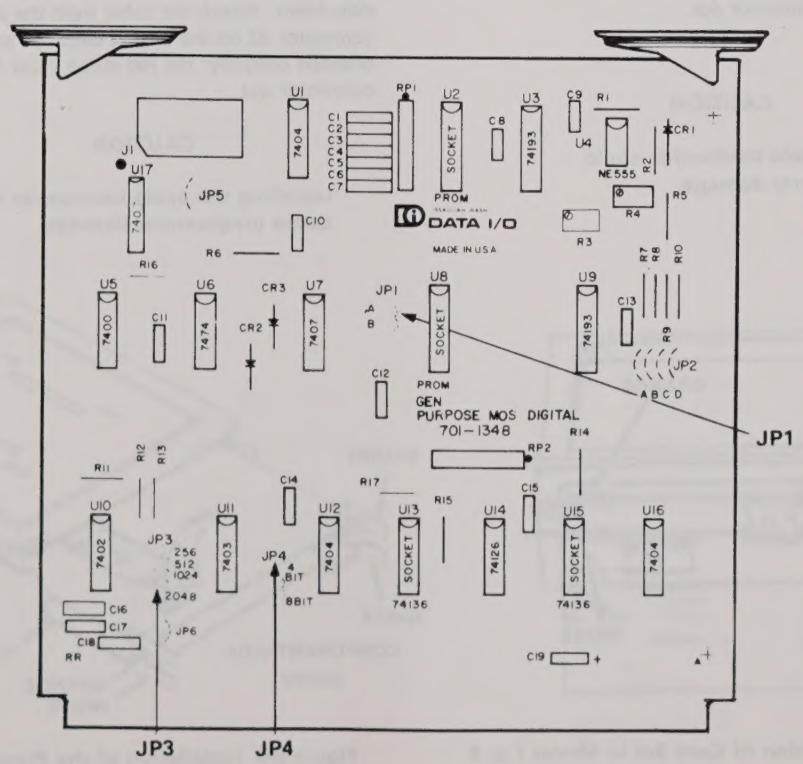


Figure 2-1. Digital Card Jumper Locations

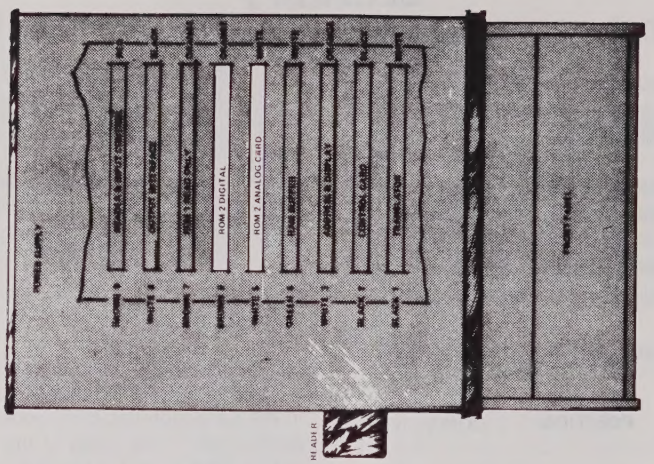


Figure 2-2. Installation of Card Set in Model 3 or 5

2.2.2 MODELS 7 AND 9

Refer to Figure 2-3.

The card set access door is located at the front of the programmer on the right-hand side. Open the door from the bottom to expose the card slots. The card guides are colored white/white and brown/orange to correspond with the extractor tabs on the cards. Insert both cards component-side-down — the analog card in the white/white slot and the digital in the brown/orange. Attach the cable from the socket receptacle to connector J2 on the analog card. Be sure the cable is oriented correctly: the red stripe must align with the connector dot.

CAUTION

Installing the cable backwards could cause programmer damage.

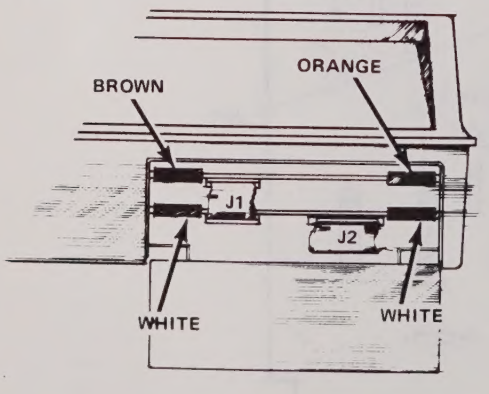


Figure 2-3. Installation of Card Set in Model 7 or 9

2.2.3 SYSTEMS 17 AND 19

Refer to Figure 2-4.

The card set should normally remain in the Programming Pak frame. Install the Programming Pak into the programmer by sliding it into the opening and lowering into position. Press gently on the handle to insure connector mating.

If the card set needs to be installed in its Programming Pak frame, insert the analog card in the white/white slot and the digital card in the brown/orange slot. With the Programming Pak face up, install both cards component-side-down. Attach the cable from the socket receptacle to connector J2 on the analog card. Be sure the cable is oriented correctly: the red stripe must align with the connector dot.

CAUTION

Installing the cable backwards could cause programmer damage.

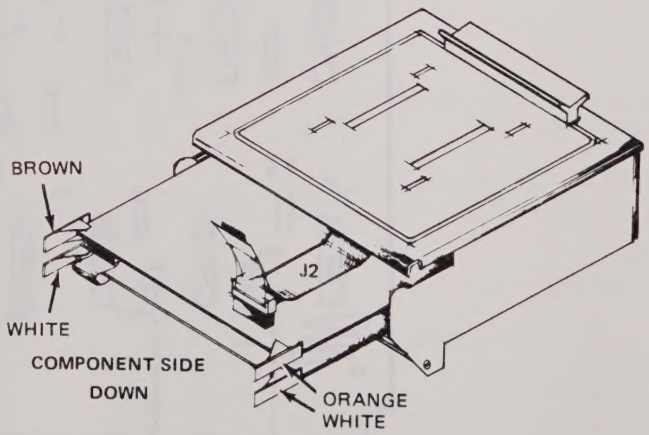


Figure 2-4. Installation of the Program Card Set in the Programming Pak

SECTION 3
OPERATION

The Program Card Set provides the link between the device in the socket adapter and the programmer's memory and control electronics. Its functions are directly controlled by the programmer. Complete instructions for operations using the card set are in the programmer instruction manual.

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SECTION 4
CALIBRATION

4.1 INTRODUCTION

Calibration includes checks of power supply levels, steady-state tests of critical programming parameters, and verification of resistively loaded programming waveforms. The need for calibration varies with the amount of use, but calibration is suggested at least every ninety days. For calibration by the customer, the procedure in this section should be followed in sequence.

NOTE

If any adjustment is necessary, complete the entire calibration procedure.

4.2 TEST SET-UP

The following equipment is required to perform a calibration:

a. Data I/O Universal Calibrator, P/N 910-1071

b. Calibration Extender:

Models 1-5	P/N 910-1136
Model 9	P/N 910-1074
System 19	P/N 910-1521

c. Digital voltmeter (DVM) — Fluke Model 8000A or equivalent.

d. A potentiometer adjustment tool

e. Dual-trace oscilloscope — Tektronix 465 or equivalent

f. A jumper wire approximately 12 inches in length

g. Data I/O interconnection cables:

Models 1-5	P/N 709-1613
Model 9	P/N 709-2608, 709-1613
System 19	P/N 709-2612, 709-1613

h. Calibrator Program Adapter

To prepare for calibration of the programmer power supplies and the Program Card Set, remove the card set from the programmer and connect the Universal Calibrator according to the following instructions:

4.2.1 MODELS 1-5

Refer to Figure 4-1.

a. Make sure the programmer power is OFF.

b. Remove the cover from the programmer and remove the Program Card Set from the card cage.

c. Disconnect the 16-conductor cable from J1 on the digital card; disconnect the 26-conductor cable from J2 on the analog card.

CAUTION

Connector pins are fragile; use a suitable tool, such as a small screwdriver, when removing cables from their connectors.

d. Install the Extender Card, P/N 910-1136, (with the Universal Calibrator attached) into the programmer's analog card position (white/white). Be sure that the edge of the Extender Card is securely seated. Reinstall the digital card in the digital card position (brown/orange) in the programmer card cage.

e. Connect the 16-conductor cable from J1 on the analog card to J1 on the Universal Calibrator. Connect the 26-conductor cable from J2 on the analog card to J2 on the Universal Calibrator. Be sure the cables are oriented correctly: the red stripes must align with the connector dots.

f. Plug the Calibrator Program Adapter into the Program Adapter socket on the Universal Calibrator.

CAUTION

Be sure the 910-XXXX part number corresponds to the 909-XXXX part number of the Program Card Set.

g. Connect the DVM ground lead to the GND test point on the Universal Calibrator.

h. Turn the programmer power ON. Prepare the programmer for calibration using the following key sequence:

RESET
ROM2 — ROM2
MANUAL
PROGRAM
START

Figure 4-1. Set-up of Models 1-5 for DC Calibration.

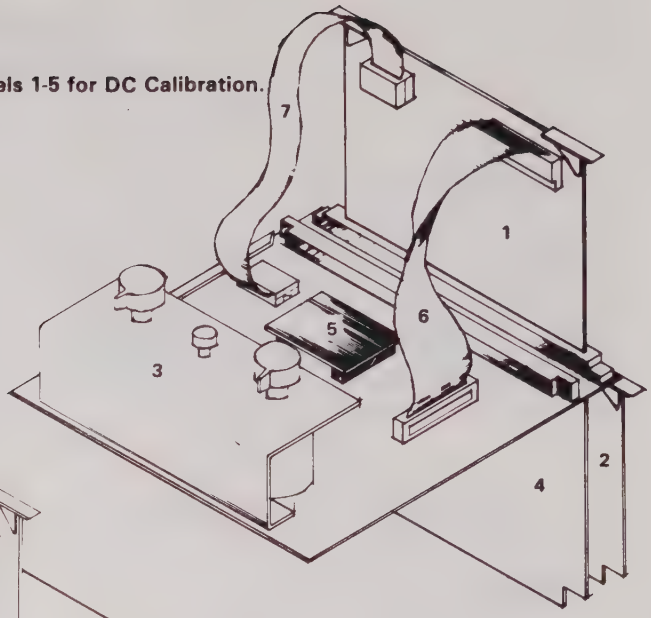
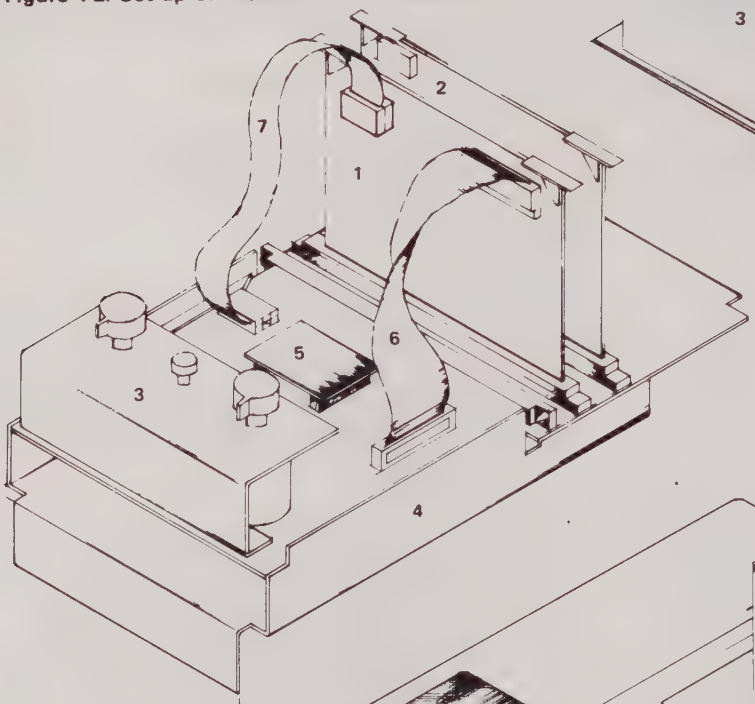
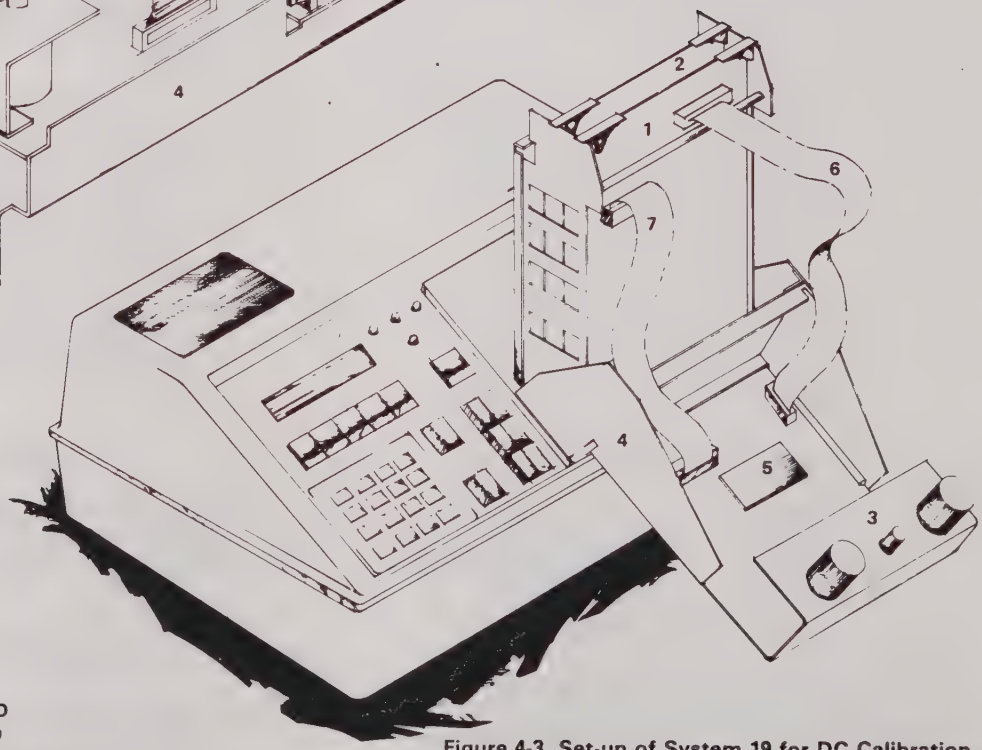


Figure 4-2. Set-up of Model 9 for DC Calibration.





1. ANALOG CARD
2. DIGITAL CARD
3. UNIVERSAL CALIBRATOR
4. CALIBRATION EXTENDER
5. CALIBRATOR PROGRAM ADAPTER
6. 26-CONDUCTOR CABLE
7. 16-CONDUCTOR CABLE

Figure 4-3. Set-up of System 19 for DC Calibration.

4.2.2 MODEL 9

Refer to Figure 4-2.

a. Make sure the programmer power is OFF.

b. Open the Program Card Set access door from the bottom. Remove the Program Card Set.

CAUTION

Connector pins are fragile; use a suitable tool, such as a small screwdriver, when removing cables from their connectors.

c. Disconnect the 16-conductor cable from J1 on the digital card; disconnect the 26-conductor cable from J2 on the analog card.

d. Install the Extender Card, P/N 910-1074, (with the Universal Calibrator attached) into the programmer's digital card position (brown/orange). Be sure that the edge of the Extender Card is securely seated. Install the Digital and Analog cards into the 1074 calibration extender according to Figure 4-2.

e. Connect the 16-conductor cable from J1 on the analog card to J1 on the Universal Calibrator. Connect the 26-conductor cable from J2 on the analog card to J2 on the Universal Calibrator. Be sure the cables are oriented correctly: the red stripes must align with the connector dots.

f. Plug the Calibrator Program Adapter into the Program Adapter socket on the Universal Calibrator.

CAUTION

Be sure the 910-XXXX part number corresponds to the 909-XXXX part number of the Program Card Set.

g. Connect the DVM ground lead to the GND test point on the Universal Calibrator.

h. Turn the programmer power ON. Prepare the programmer for calibration using the following key sequence:

KEYBOARD
EXECUTE
NORMAL/INVERT switch to INVERT

4.2.3 SYSTEM 19

Refer to Figure 4-3.

a. Make sure the programmer power is OFF.

b. Remove the Programming Pak from the programmer.

c. Insert the Calibration Extender, P/N 910-1521, in the same way as the Programming Pak, being sure to seat it properly in the programmer's mating connector.

d. With the handle of the Programming Pak down, connect the 64-pin connectors of the Programming Pak and Calibration Extender. Be sure the connectors mate securely.

e. Slide the Universal Calibrator securely into the card slots at the front of the Calibration Extender.

f. Connect the 26-conductor cable from J2 of the analog card to J2 of the Universal Calibrator, making sure to align the red stripe with the connector dot.

g. Disconnect the 16-conductor cable from J1 on the digital card and route it to J1 on the Universal Calibrator, making sure to align the red stripe with the connector dot.

h. Plug the Calibrator Program Adapter into the Program Adapter slot on the Universal Calibrator.

CAUTION

Be sure the 910-XXXX part number of the Calibrator Program Adapter corresponds to the 919-XXXX part number of the Programming Pak.

i. Connect the DVM ground lead to GND test point on the Universal Calibrator.

j. Turn the programmer power ON. Prepare the programmer for calibration using the following key sequence:

SELECT
C1 (calibrate ON)
START

k. Press:

KEYBD
ENTER

The TEST light comes ON and remains ON throughout calibration.

To exit calibration, press:
SELECT
C0 (calibrate OFF)
START
(Test light goes OFF.)

l. Press START.

4.3 PROCEDURES FOR CALIBRATION

The Calibration Chart, between pages 4-4 and 4-5, gives the steps for complete DC calibration. It is to be used only with the Calibrator Program Adapter specified in the title block of the chart.

The first five steps on the Calibration Chart cover the level checks of the programmer power supplies. If any adjustment is necessary in these steps, refer to the Programmer Manual. The remaining steps provide information for calibration of the Program Card Set.

- The PROGRAMMER WORD COUNT column is divided into three portions: DEC (Decimal), HEX (Hexadecimal), and OCT (Octal). When performing each step, set the address (word count) corresponding to the address number base of the programmer in use. For instance, with a programmer having a hexadecimal address readout, ignore the DEC and OCT columns.

CAUTION

DO NOT leave Word Count (address) advanced beyond [illegible] for extended periods. Static conditions created by the Universal Calibrator may cause thermal damage to components if the programmer is left unattended with advanced word count.

- The TEST DESCRIPTION column specifies the function to be checked in each step. In most cases, the steps simply require a DVM reading to insure that a level is within tolerance. Some steps, labeled Adjustment Steps, give a nominal (NOM) value and prescribe adjustment to that value if the level is out of the MIN-MAX range.

- The ADJUSTMENT column calls out potentiometer designations. The first four entries in the ADJ column refer to power supply potentiometers located on the power supply board of the programmer. The remaining entries in the ADJ column refer to potentiometers on the analog card. Refer to Figure 4-4 for locations of the potentiometers.

- The SWITCH POSITIONS column gives the switch settings for S2 and S3 on the Universal Calibrator. S2 is the load-select switch; S3 is the line-select switch. Each step on the Calibration Chart may require changing of switch positions. With the proper S2 and S3 positions selected, press S1 to make an accurate reading, and keep the switch depressed only long enough to complete the step.

CAUTION

DO NOT keep S1 depressed for extended periods. Certain measurements induce high programmer current levels. Extended high-current operation (S1 depressed) may damage sensitive electronic components.

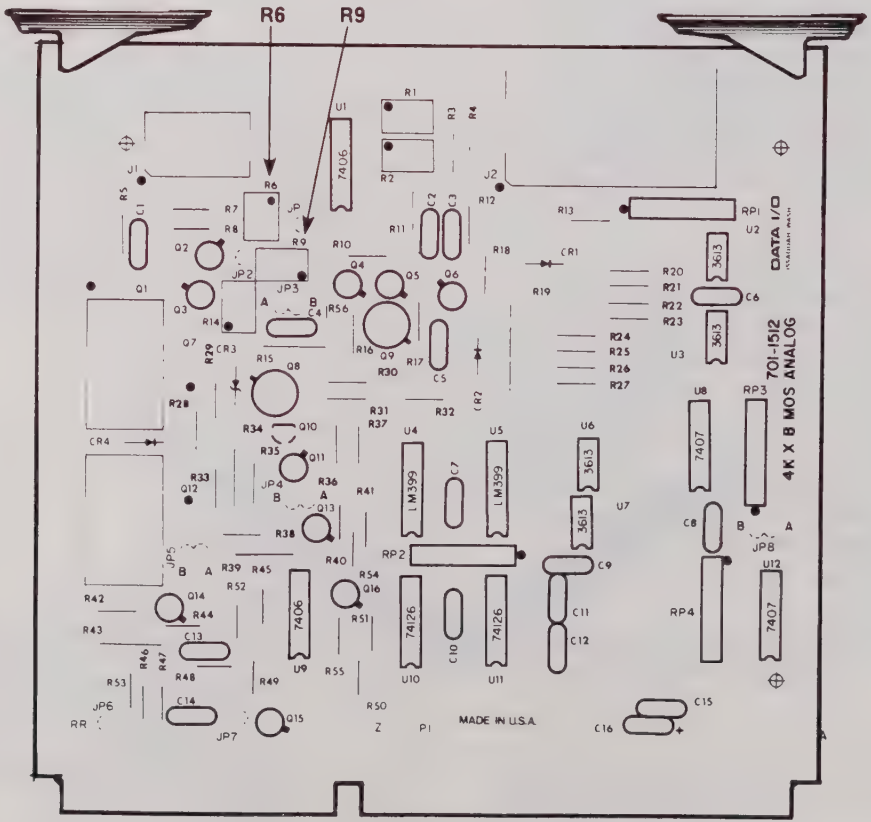


Figure 4-4. Analog Card Adjustment Locations

- The TEST POINT column gives test point locations for the DVM probe. Most test points are located on the Universal Calibrator; some points are located on the program card. For instance, if a test point is designated as U6 P8, the DVM probe should be placed on pin 8 of integrated circuit U6 on the card indicated in the COMMENTS column.

- The LIMITS column is divided into three portions: MIN (minimum), NOM (nominal), and MAX (maximum). The values given are in volts and indicate the range into which a given DVM reading should fall. If a reading is within the limits, no adjustment is required and the programmer (or Program Card Set) passes a particular test. If a reading falls outside of the given limits, or if it cannot be adjusted to fall within the limits (in adjustment steps), the card is nonfunctional and should not be used for programming.

- The COMMENTS column on the right side of the chart provides information for certain calibration steps including call-outs of programmer operations required in some steps. The programmer provides signals to the card set on the Address bus, the Data Input bus, the START/STOP line and the FWD/REV line. The card set provides signals to the programmer on the RESET line, the VOL/VOH select line and the Data Output bus. In the course of calibration, the programmer is used to observe or set the following conditions:

- State of the START/STOP line
- State of the FWD/REV line
- Data on the DO bus
- Data on the DI bus

Key sequences for observing these conditions are given in the following paragraphs (4.3.1 — 4.3.5). Follow the tests on the Calibration Chart step-by-step, and refer to paragraphs 4.3.1 — 4.3.5 as necessary.

MODEL 9 USERS NOTE

Some of the following operations are performed differently on Model 9's with different revisions of software. Perform the following test to determine whether to refer to steps for Revision "A" software or to steps for Revision "B" or later software.

1. *Turn power OFF.*
2. *Observe the LOAD indicator while turning power ON.*
3. *If the LOAD indicator remains ON, refer to key sequences for Revision "B" or later software.*
4. *If the LOAD indicator turns OFF, refer to key sequences for Revision "A" software.*

4.3.1 CHECK THE STATE OF THE START/STOP LINE

For steps that require confirmation of the state of the START/STOP line, perform the check as follows. To continue testing after confirming a STOP condition, START the programmer according to paragraph 4.3.2.

Models 1, 2, 3 and 5:	Observe the START and STOP indicators.
Model 9:	Press the PROM key and observe the data display. The programmer is in STOP if the display is blank; in START if the display shows data.
System 19:	Observe the START light. If the START light is on, the programmer is in START.

4.3.2 SET THE STATE OF THE START/STOP LINE

Models 1, 2, 3 and 5:	Press the START/STOP key.
Model 9:	a. Press KEYBOARD to stop.
	b. Press EXECUTE to start.
System 19:	a. To set the programmer in START, press KEYBD, ENTER and START.
	b. To set programmer in STOP, press KEYBD.

4.3.3 SET THE STATE OF THE FWD/REV LINE

To set the programmer in FORWARD or in REVERSE:

Models 1, 2, 3 and 5:	Press the FWD key or the REV key.
Model 9:	See MODEL 9 USERS NOTE, paragraph 4.3, to determine the right revision letter.
Revision "A" Software:	Halt the programmer in FWD and in REV by entering data at an address and causing a mis-verify:
	a. Ground J1-16 on the analog card.
	b. Press LOAD.
	c. Press EXECUTE.
	d. Press KEYBOARD.
	e. Key in data — Ø hex — at address ØØ1.
	f. Press VERIFY.
	g. Press EXECUTE. The programmer will mis-verify

at the address containing data and will STOP in FWD.

h. Press SKIP. The programmer will mis-verify at the address containing data and will halt in REV.

Revision "B" or later Software: Press the FWD key to set the programmer in FORWARD and the REV key to set it in REVERSE.

System 19: With KEYBD selected, press ENTER to set the programmer in FORWARD. Press ENTER and then REVIEW to set it in REVERSE.

4.3.4 LOAD DATA ONTO THE DI BUS

The data on the Calibration Chart is to be loaded on the DI bus using the programmer keyboard.

Models 1, 2 and 5: Key in binary data called out on the Calibration Chart. (Bits called out must be ON, bits not called out must be OFF.) Perform the necessary number-system conversions if using an octal or hexadecimal keyboard. Confirm correct data by checking the binary DI display.

Model 3: Use an external source, such as a paper tape reader, to put binary data on the DI bus.

Model 9: See MODEL 9 USERS NOTE, paragraph 4.3, to determine the correct revision letter.

Revision "A" Software: Halt the programmer in the automatic program mode with data on the DI bus.

a. Clear RAM: Select INVERT. Then press and hold the EDIT key while pressing LOAD.

b. Press the KEYBOARD key, and key in hex data called out on the Calibration Chart.

c. Press the PROGRAM key.

d. Ground J1-16 on the analog card.

e. Press EXECUTE and wait for the programmer to abort.

f. Press STOP, KEYBOARD and EXECUTE.

g. Disconnect J1-16 from ground.

h. SET the address specified on the Calibration Chart in order to make the measurement.

Revision "B" or later Software: With the KEYBOARD indicator illuminated and all the others OFF, use the hex keypad to key in the Model 9 hex data called out on the Calibration Chart.

System 19:

a. Press KEYBD, key in the address and press ENTER.

b. Key the System 19 hex data into RAM at the specified address.

c. Press ENTER and then REVIEW.

4.3.5 CONFIRM DATA ON THE DO BUS

Models 1, 2, 3 and 5: Compare the bit callout on the Calibration Chart with the OUTPUT DATA display on the programmer front panel. Bits not called out must be OFF.

Model 9: With the EXECUTE light ON, press the PROM key and observe the data display on the programmer front panel. Data must match the hex callouts on the Calibration Chart.

System 19: With KEYBD selected, press the DEVICE DATA key. Hold it down while reading the hex data. The programmer must be in START.

Calibration Chart

DATA I/O
Programming systems for tomorrow, today

CALIBRATION CHART 017-1512 | PROGRAM CARD 909-1512
FIXTURE 702-1071 | MANUFACTURER INTEL, T.I.
PAGE 1 OF 2 | PROGRAM ADAPTER 910-1512 | PROM Single Voltage MOS

DATE	REV	REVISION RECORD	DR	CK
6-2-78	A	RELEASE	DB	
11-78	-	ECN #2565	FS	
3-13-80	B	ECN #3407	EF	
4-21-83	C	ECN #4820	EF	

CAL. ADAPT. HEX DATA (POS. LOGIC) LOCATION U2	U1	TEST DESCRIPTION	STEP NO.	PROGRAMMER WORD COUNT DEC	HEX	OCT	SWITCH POSITIONS S2	S3	MEASUREMENT TEST PT.	ADJ.	LIMITS MIN	NOM	MAX
44	00	+24	1-1	000	00	000			+24	R26	23.5	24.0	24.5
44	00	POWER +48	1-2	000	00	000			+48	R24	49.4	49.7	49.8
44	00	SUPPLIES +5	1-3	000	00	000			+5	R18	5.05	5.1	5.15
44	00	-9	1-4	000	00	000			-9	R40	-9.2	-9.0	-8.8
44	00	PROGRAMMABLE SUPPLY	1-5	000	00	000			PROG V		11.0		14.0
44	00	VCC PROGRAM (1)	2-1	001	01	001	5	1	TP3	R6	4.75	5.00	5.25
44	00	VCC REGULATION	2-2	001	01	001	6	1	TP3		4.50		5.25
44	00	COMPARATOR REFERENCE	3-1	001	01	001			U5 P8		1.4		1.8
44	00	$\overline{CE}$ PROGRAM (2)	4-1	002	02	002	7	5	TP3		4.75		5.25
44	01	$\overline{CE}$ VERIFY	4-2	003	03	003	7	5	TP3		0.0		0.4
44	30	VPP PROGRAM (3)	4-3	004	04	004	3	6	TP3	R9	24.0	25.0	26.0
44	30	VPP CURRENT LIMIT	4-4	004	04	004	5	6	TP3		-0.05		0.4
44	30		4-5	004	04	004							
44	00	VPP VERIFY	4-6	005	05	005	3	6	TP3		4.75		5.25
44	00	PD/$\overline{PGM}$ PROGRAM (6)	4-7	006	06	006	7	7	TP3		4.75		5.25
44	02	PD/$\overline{PGM}$ VERIFY	4-8	007	07	007	7	7	TP3		0.0		0.4
C4	00	BIT 8 PROGRAM	5-1	008	08	010	7	8	TP3		-0.05		0.4
C4	00	BIT 7 PROGRAM	5-2	008	08	010	7	9	TP3		4.75		5.25
C4	00	BIT 6 PROGRAM	5-3	008	08	010	7	10	TP3		-0.05		0.4
C4	00	BIT 5 NO PROGRAM	5-4	008	08	010	7	11	TP3		4.75		5.25
C4	00	BIT 4 PROGRAM	5-5	008	08	010	7	12	TP3		-0.05		0.4
C4	00	BIT 3 NO PROGRAM	5-6	008	08	010	7	23	TP3		4.75		5.25
C4	00	BIT 2 PROGRAM	5-7	008	08	010	7	22	TP3		-0.05		0.4
C4	00	BIT 1 NO PROGRAM	5-8	008	08	010	7	21	TP3		4.75		5.25
C4	00	BIT 8 NO PROGRAM	5-9	008	08	010	7	8	TP3		4.75		5.25
C4	00	BIT 7 PROGRAM	5-10	008	08	010	7	9	TP3		-0.05		0.4
C4	00	BIT 6 NO PROGRAM	5-11	008	08	010	7	10	TP3		4.75		5.25
C4	00	BIT 5 PROGRAM	5-12	008	08	010	7	11	TP3		-0.05		0.4
C4	00	BIT 4 NO PROGRAM	5-13	008	08	010	7	12	TP3		4.75		5.25

COMMENTS

Switch S1 must be depressed for accurate readings.
CAUTION: DO NOT LEAVE S1 DEPRESSED FOR EXTENDED PERIODS.

Adjustments are located on the power supply board.
See programmer manual.
See NOTE 1.

Adjustment Step.

Test Point Located on Analog Card.

Adjustment Step.
Confirm programmer in STOP.

Set programmer in START.

	MODEL 5	9	19	
LOAD	BITS 2,4,6,8 ON	55	55	DI BUS
CONFIRM	BITS 2,4,6,8 ON	55	55	DO BUS
LOAD	BITS 1,3,5,7 ON	55	AA	DI BUS
CONFIRM	BITS 1,3,5,7 ON	AA	AA	DO BUS

CAL. ADAPT. HEX DATA (POS. LOGIC) LOCATION U 2	U 1	TEST DESCRIPTION	STEP NO.	PROGRAMMER WORD COUNT DEC	HEX	OCT	SWITCH POSITIONS S2	S3	MEASUREMENT TEST PT.	ADJ.	LIMITS MIN	NOM	MAX
C4	00	BIT 3 PROGRAM	5-14	008	08	010	7	23	TP3		-0.05		0.4
C4	00	BIT 2 NO PROGRAM (5)	5-15	008	08	010	7	22	TP3		4.75		5.25
C4	00	BIT 1 PROGRAM (4)	5-16	008	08	010	7	21	TP3		-0.05		0.4
C4	40	DATA DISABLE	5-17	009	09	011	7	21					
44	20	ADDRESS TEST VIL (7)	6-1	682	2AA	1252	7	20	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-2	682	2AA	1252	7	19	TP3		4.8		5.15
44	00	ADDRESS TEST VIL	6-3	682	2AA	1252	7	18	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-4	682	2AA	1252	7	17	TP3		4.8		5.15
44	00	ADDRESS TEST VIL	6-5	682	2AA	1252	7	16	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-6	682	2AA	1252	7	15	TP3		4.8		5.15
44	00	ADDRESS TEST VIL	6-7	682	2AA	1252	7	14	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-8	682	2AA	1252	7	13	TP3		4.8		5.15
44	00	ADDRESS TEST VIL	6-10	682	2AA	1252	7	2	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-11	682	2AA	1252	7	3	TP3		4.75		5.15
44	00	ADDRESS TEST VIL	6-12	682	2AA	1252	7	4	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-13	1365	555	2525	7	20	TP3		4.75		5.15
44	00	ADDRESS TEST VIL	6-14	1365	555	2525	7	19	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-15	1365	555	2525	7	18	TP3		4.75		5.15
44	00	ADDRESS TEST VIL	6-16	1365	555	2525	7	17	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-17	1365	555	2525	7	16	TP3		4.75		5.15
44	00	ADDRESS TEST VIL	6-18	1365	555	2525	7	15	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-19	1365	555	2525	7	14	TP3		4.75		5.15
44	00	ADDRESS TEST VIL	6-20	1365	555	2525	7	13	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-21	1365	555	2525	7	2	TP3		4.75		5.15
44	00	ADDRESS TEST VIL	6-22	1365	555	2525	7	3	TP3		0.0		0.4
44	00	ADDRESS TEST VIH	6-23	1365	555	2525	7	4	TP3		4.75		5.15
44	00	GROUND TEST	7-1	1365	555	2525	8	24	TP3		0.0		0.08
44	00	All TEST VIL	8-1	2047	7FF	3777			R50		0.0		0.4
44	00	All TEST VIH	8-2	2048	800	4000			R50		4.75		5.15
44	00	4K GATE TEST	9-1	000	00	000							
44	00	← DATA PATTERN FOR ALL WORDS NOT SHOWN											

CALIBRATION CHART 017-1512

PAGE 2 OF 2

	MODEL 5	9	19	
LOAD	BITS 1,3,5,7 ON	55	AA	DI BUS
CONFIRM	BITS 1,3,5,7 ON	AA	AA	DO BUS
LOAD	ALL BITS ON	FF	FF	DO BUS
CONFIRM	ALL BITS OFF	00	00	DI BUS

Test Point: Top of R50 on analog card. See NOTE 2.

See Note 3.

NOTES:
1. For the System 19, the limits of this supply are 0.1 volt less than specified.
2. Omit these tests when using programmers with less than 4K of RAM.
3. Models 1-5: 1) Press the STOP key; 2) Ground the TOP of R45 on the analog card; 3) Confirm bit 7 ON on DO Bus.
   Model 9: 1) Press the KEYBOARD key; 2) Hold SET depressed and enter FFF on keyboard; 3) Release SET; 4) Confirm FFF in Address Display.

NOTES (cont'd.):
System 19: 1) Press KEYBOARD; 2) Enter FFF on keyboard; 3) Confirm FFF in Address Display.

4.4 WAVEFORM OBSERVATION

Programming waveforms should be observed after complete DC calibration of the programmer and Program Card Set. Set-up instructions assume that the calibration equipment is already installed for calibration per paragraph 4.2.

In waveform observation, oscilloscope displays are to be compared with the Timing Diagram. These waveforms, indicated by circled digits on the Timing Diagram, have the same reference on the Calibration Chart. Waveforms are selected using Universal Calibrator switches S2 and S3 as specified on the Calibration Chart.

4.4.1 CALIBRATION EQUIPMENT SET-UP

Refer to Figure 4-5.

a. Make sure that the programmer power is OFF.

b. Remove the digital card from the card slot.

c. Check the Timing Diagram to determine the number of the reject jumper. Find and remove the jumper on the digital card (if installed), making sure to note the position in which it is installed.

CAUTION

Be sure to replace the reject (abort) jumper (if it was installed) in the proper position after waveform observation.

d. Disconnect the 16-conductor cable at J1 of the Universal Calibrator.

e. Connect the free end of the 16-conductor cable to digital card J1, making sure that the red cable stripe and pin 1 are properly oriented.

f. Connect the triggered input of a dual-trace oscilloscope to the digital-card test point as indicated to the left of the TEST waveform on the Timing Diagram. Connect an input probe to TP3 on the calibrator.

g. Reinstall the digital card in the slot from which it was removed.

h. Check the NOTES column on the Timing Diagram to determine whether the Program Card Set defaults to VOH or VOL for calibration. If and only if the card set defaults to VOH, ground J1-16 (Read Enable line) to the GND test point on the Universal Calibrator.

CAUTION

Do not connect J1-16 to any other potential; damage to programmer components may result.

4.4.2 TEST PROCEDURE

Observing programming waveforms requires putting data in RAM and causing the programmer to attempt to program a nonexistent device.

1. Turn programmer power ON.

2. Prepare the programmer for keyboard data entry.

Models 1—5, press:	RESET RAM-RAM PROGRAM MANUAL START
Model 9:	Set the NORMAL/INVERT switch in NORMAL if the Program Card Set is calibrated VOH or in the INVERT position if VOL. The NOTES column on the Timing Diagram specifies the correct polarity. Press: KEYBOARD.
System 19 press:	KEYBD Ø ENTER

3. Key in data for bit 1 at several addresses:

Models 1—5:	Enter bit 1 at several addresses and confirm that bit 1 is ON and all other bits are OFF on the DI display.
Model 9:	Enter hex data "Ø1" at several addresses.
System 19:	Enter hex data "Ø1" at several addresses. Check the NOTES column on the Timing Diagram to determine the correct data polarity. If the Timing Diagram indicates VOL, enter a hex "E" for 4-bit card sets; "FE" for 8-bit card sets. Return to address ØØØ.

4. Select the PROGRAM mode:

Models 1—5, press:	RESET PROGRAM AUTO RAM-ROM2

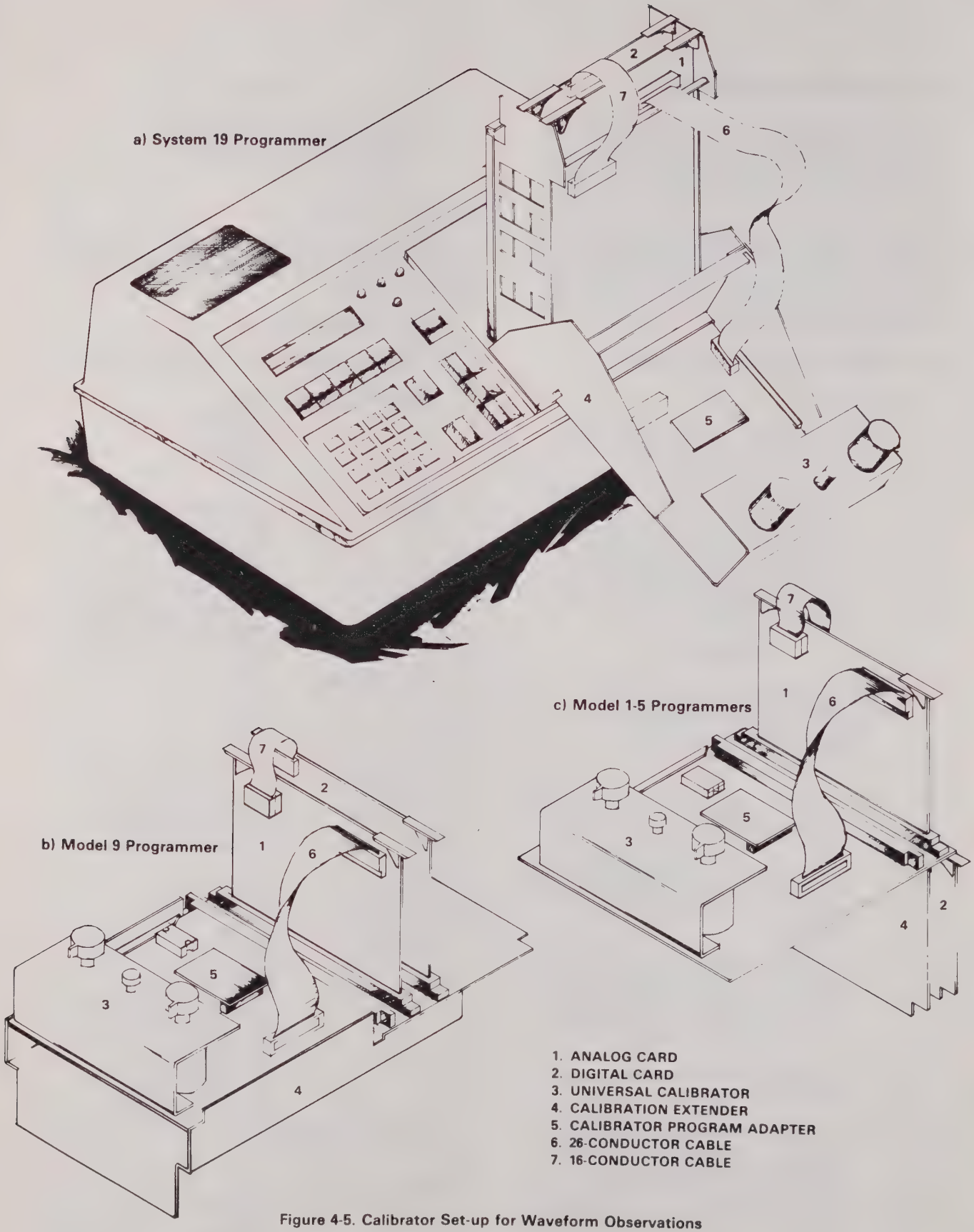
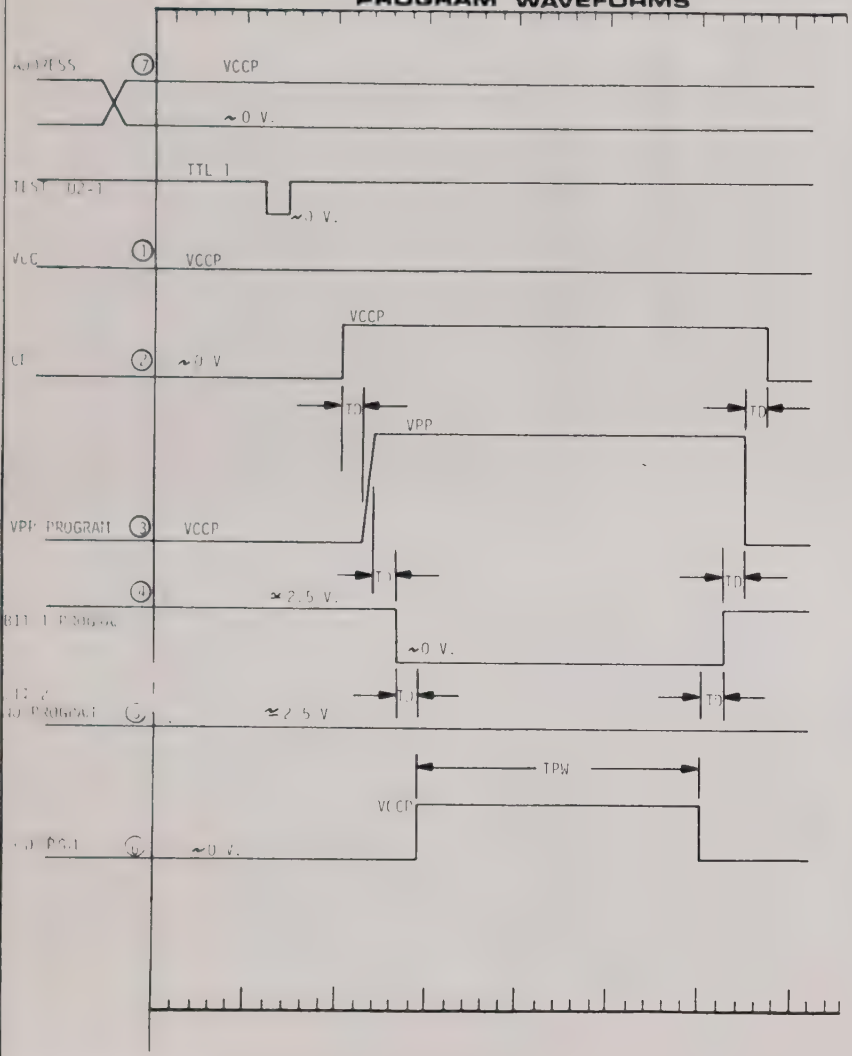


Figure 4-5. Calibrator Set-up for Waveform Observations

DATE	SYM	REVISION RECORD	DR	CK
6-2-78	A	RELEASE	A.B.	
11-7-78	-	ECN #2594	FS	
12-18-78	B	ECN #2582	JT	

PROGRAM WAVEFORMS



NOTES

DIGITAL CARD JUMPERS

JP1 = A=1 Pulse Reject
JP2 = A,B,C,D, SHORT
JP3 = 2048
JP4 = 8 Bit
JP5 = OPEN
JP6 = SHORT
JP7 = SHORT
JP8 = SHORT

WAVEFORM VARIABLES

TD > 2 us
TPW = 50 + 5 us
~9% duty cycle
VCCP = 5.0 + .25 V.
VPP = 25.0 + 1.0 V.

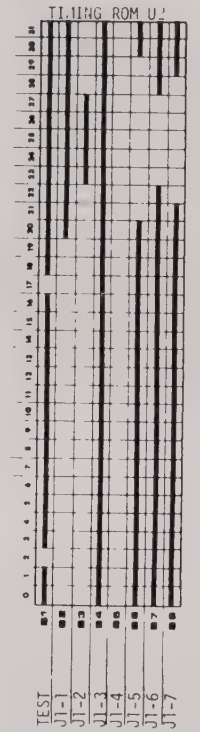
For calibration, the card set polarity defaults to VOL.

○ These waveforms correspond to callouts on the Calibration Chart. Switch S2 and S3 of the Universal Calibrator to indicated positions to obtain waveforms. Refer to Performance Check section of manual for detailed steps.

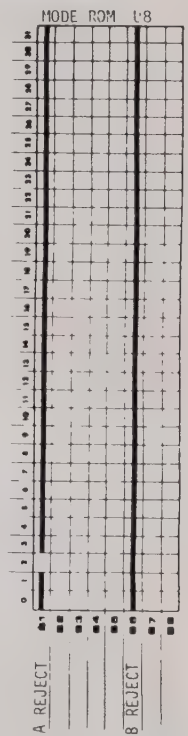
TRUTH TABLES

LINE : HI(1); NO LINE : LOW(Ø)

TIMING ROM U7



MODE ROM U8



DATA I/O ISSAQUAH, WASH.

INTEL , T.I. SINGLE VOLTAGE MOS	DRAWN BY: K. LANZ APPROVED BY:
TITLE: TIMING DIAGRAM	
DATE: 6-2-78	DRAWING NUMBER: 007-1512

Model 9, press: PROGRAM

System 19, press: PROG

5. Initiate waveforms:

Models 1 — 5, press: START

Model 9, press: EXECUTE

System 19, press: START

After initiating the programming sequence, the programmer will halt at the first address which has data. Refer to the Timing Diagram and Calibration Chart by the circled digits (1 , 2 , 3 , ...). Make the indicated switch selections with S2 and S3 on the Universal Calibrator.

Observe specific waveforms relative to the triggered test pulse by pressing S1 on the calibrator. S3 is used to route analog card output to TP3 (the oscilloscope probe); S2 selects resistive loads that are applied when S1 is pressed. All other information on the Calibration Chart is of no importance during waveform observation.

CAUTION

When S1 is depressed, high currents are induced within the programmer; do not hold S1 depressed for extended periods.

6. Stop programming:

Models 1 — 5 and 9, press: STOP

System 19, press KEYBD

4.4.3 REJECT JUMPER REINSTALLATION AND ABORT TEST

Before putting the Program Card Set back in use, it is necessary to reinstall the reject (abort) jumper and confirm the operation of the abort function on the digital card.

CAUTION

The reject jumper must be reinstalled. Otherwise, the device's programming specifications will be violated, and the programmer and/or cardset may be damaged by a prolonged attempt to program a defective device.

1. Turn the programmer power OFF.

2. Remove the digital card from the card slot.

3. Refer to the Timing Diagram for the reject jumper number and make sure to install the jumper in the position from which it was removed.

4. Reinstall the digital card in the card slot.

5. With the Universal Calibrator switches set to observe Vcc, connect the scope probe to TP3 on the Universal Calibrator and trigger on TP3.

7. Repeat the key sequence in the Waveform Test Procedure, paragraph 4.4.2 steps 1-5. Note with the oscilloscope that the waveform display is terminated by the programmer. This indicates that the abort function of the digital card is operative. The System 19 will display ERR 22.

NOTE

The digital card has one or more potentiometers for calibrating various timing functions of the card set. In normal usage, the card set will rarely need to have these functions re-calibrated.

However, in the event that the card set waveforms do not conform to the specifications of the Timing Diagram contact your nearest Data I/O Service Representative for calibration information.

SECTION 5
CIRCUIT DESCRIPTION

5.1 INTRODUCTION

Data I/O Program Card Sets consist of a Digital Card, an Analog Card, and interconnecting cables. Both cards interface with the Programmer and with each other. The analog card interfaces with the PROM being programmed. Figure 5-1 gives a generalized block diagram of the relations between the cards, the Programmer, and the PROM being programmed or read.

5.1.1 DIGITAL CARD

The digital card receives data from the Programmer on the DI Bus, and from the PROM on the DO Bus. These data are compared at each bit of each PROM word both before and after programming. At each bit, the digital card continues to command PROM program pulses from the analog card until either ABORT or REJECT is signalled or until the bit is programmed.

5.1.2 ANALOG CARD

The analog card receives bit addresses, word addresses, timing, and mode commands. Analog card output consists of PROM manufacturers' specified programming voltages and currents. When specified by the manufacturer, each programmed PROM bit is tested for loading and/or leakage. Following the program cycle, PROMs are read by the analog card to verify that programmed data matches truth table data.

5.1.3 DETAILED CIRCUIT DESCRIPTION

The following paragraphs explain functional operation of the analog card and the digital card. Also included are discussions of signal flow, timing and reject conditions. Detailed circuit schematics are found at the rear of this manual — refer to these for pin-out and interconnection information.

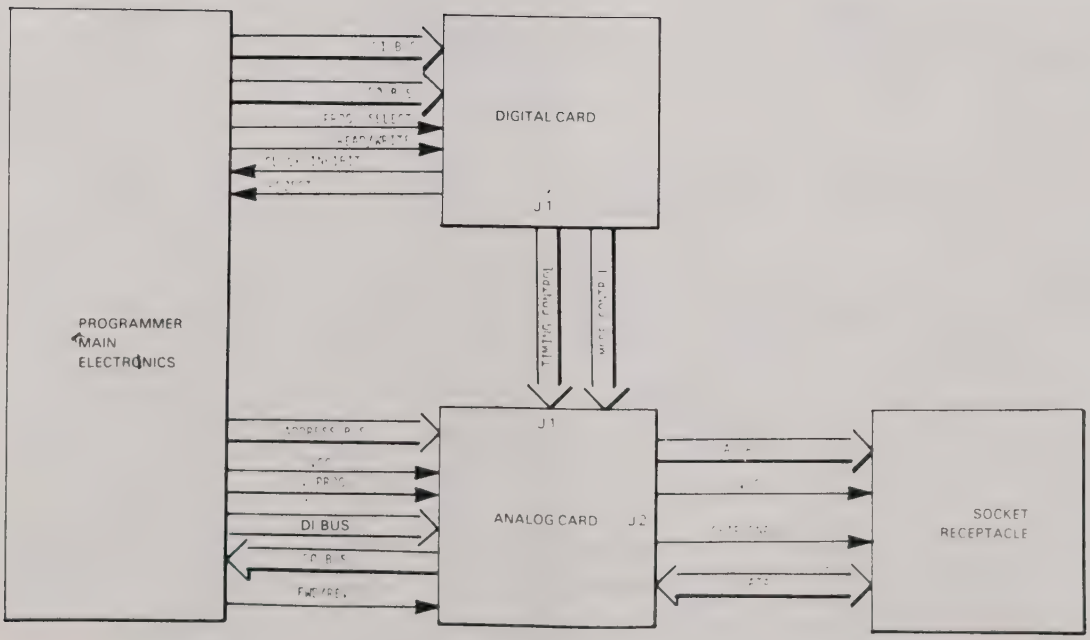


Figure 5-1. Simplified Block Diagram of Program Card Set

5.2 DIGITAL CARD

Figure 5-2 gives a generalized block diagram of the digital card. This diagram shows signal flow and functional relationships between the blocks but does not include detailed interconnect information. Refer to the schematics and timing diagram (with truth tables) for details of circuit connection and operation. The following paragraphs discuss the functions performed by the digital card.

5.2.1 SELECT AND MODE CONTROL

The select gates monitor status lines on the programmer MEU. When the digital card is selected for operation the status lines are enabled. Selection Gate output enables the digital card and pulls CLK INH (MEU) to signal the programmer to recognize the digital card. Prior to selection, the master clock is stopped and all counters and memories are initialized.

5.2.2 MASTER CLOCK

Upon selection of the digital card, the Master Clock is enabled and runs free at the frequency set by R3, R4, and C9. This clock drives the sequence counter, which addresses the Timing ROM. A clock rate output from the Timing ROM enables two-speed clock operation.

5.2.3 TIMING GENERATOR

The Timing Generator consists of a 4-bit sequence counter addressing a 32x8 Timing ROM. This combination generates timing signals for analog card control to provide the dynamic waveforms presented to the PROM during Program and Read. This generator also outputs clock rate and provides the test pulse. The test pulse is used on the digital card to enable testing of the PROM outputs during the Read portion of the programming cycle.

5.2.4 READ OPERATION

The Bit Comparator compares the DI and DO bus and outputs to the bit-to-program control gating. When Test and the Comparator output yield no bit to program, the Program Pulse Counter outputs a borrow pulse. This pulse stops the Master Clock and releases the CLK INH line. The release of CLK INH signals the programmer to deselect the digital card. When the digital card is deselected, the programmer advances the word count and reselects the digital card.

5.2.5 PROGRAM OPERATION

When Test and the Comparator output yield a bit to program, the Program Memory sets and the Program Pulse

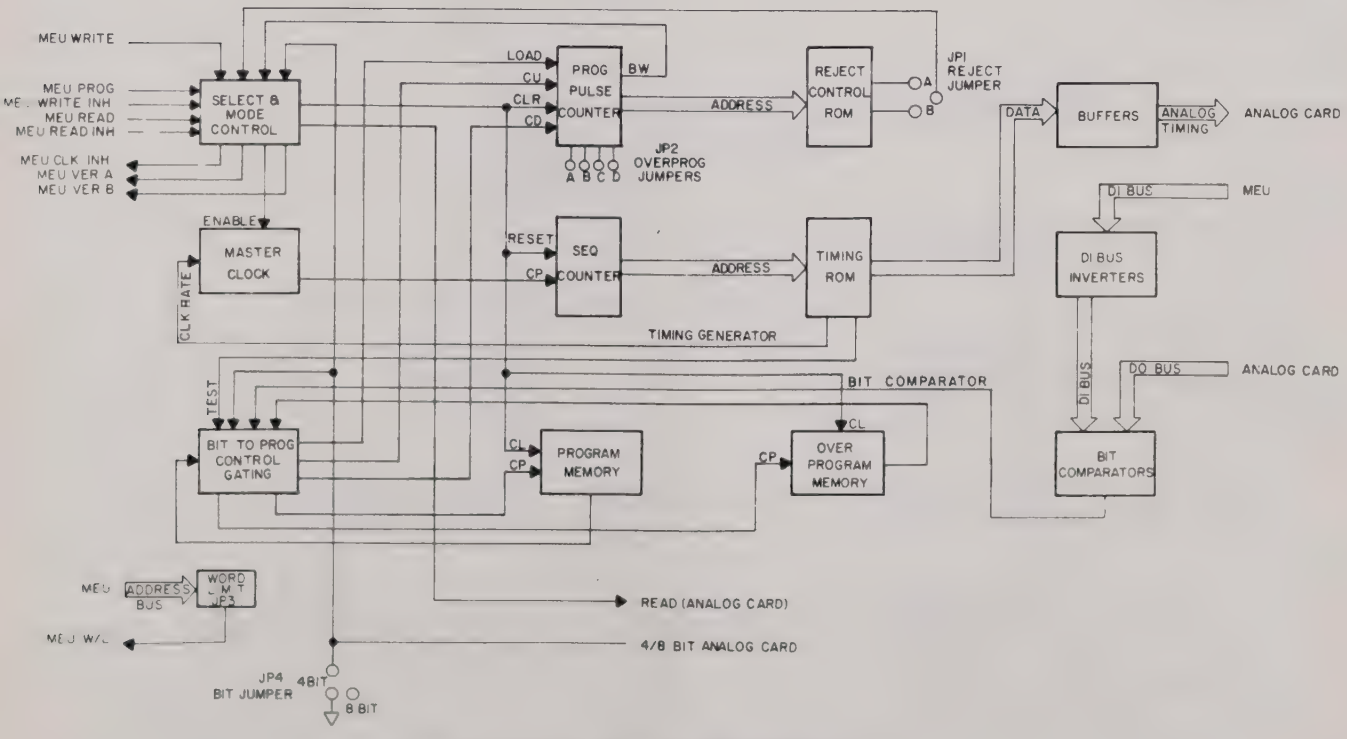


Figure 5-2. Block Diagram, 1348 Digital Card

Counter advances. The Timing Generator outputs program pulse waveforms to the analog card and loops back to Test. This sequence repeats until Test determines that the PROM bits have programmed (no bit to program), or until the Program Pulse Counter counts the maximum number of allowed program pulse attempts. This counter advances following each program pulse and addresses the Reject Control ROM. When the Counter reaches its reject count as determined by the Reject Control ROM and jumper JP1, a reject is signaled.

5.2.6 OVERPROGRAM OPERATION

With the Program Memory set (program operation in progress) and Test indicating no bit to program (PROM bits have programmed), the Program Pulse Counter loads to the binary value of the JP2 overprogram jumpers.

Loading of this counter is enabled only when the Program Memory is set. This prevents the digital card from applying any program pulses to PROM bits that were already programmed when first read. Following loading of this counter, the Overprogram Memory sets, releasing load and enabling countdown on the Program Pulse Counter. A program pulse is outputted from each countdown. When count 0 is reached, borrow from this counter stops the Master Clock and releases CLK INH. The release of CLK INH signals the programmer to deselect the digital card. With the digital card deselected, the programmer advances the word count and the entire sequence is repeated for the next word.

5.2.7 WORD LIMIT

Word Limit value is jumper-selected by JP3. This value limits the address range of the programmer through the Word Limit line on the MEU.

5.2.8 4/8 BIT MODE

The digital card is selected for either 4- or 8-bit-wide operation by the 4/8 bit line. This line is enabled by either JP4 or the socket adapter being used. When this line is low, the four high-order bits (bits 5 through 8) and VER. 8 are disabled. By this means the digital card and programmer are matched to the bit width of the PROM being programmed.

5.3 ANALOG CARD

Figure 5-3 shows a block diagram of the analog card. This diagram shows signal flow and functional relationships between the blocks, but does not include detailed interconnection information. Refer to the schematics and timing diagram (with truth tables) for details of circuit connection and operation. The following paragraphs discuss the functions performed by the analog card.

5.3.1 ADDRESS BUFFERS

Address buffers accommodate the ten incoming address lines emanating from the programmer MEU. The buffers consist of noninverting gates with uncommitted collector outputs. Buffer outputs have resistor pull-ups to PROM Vcc.

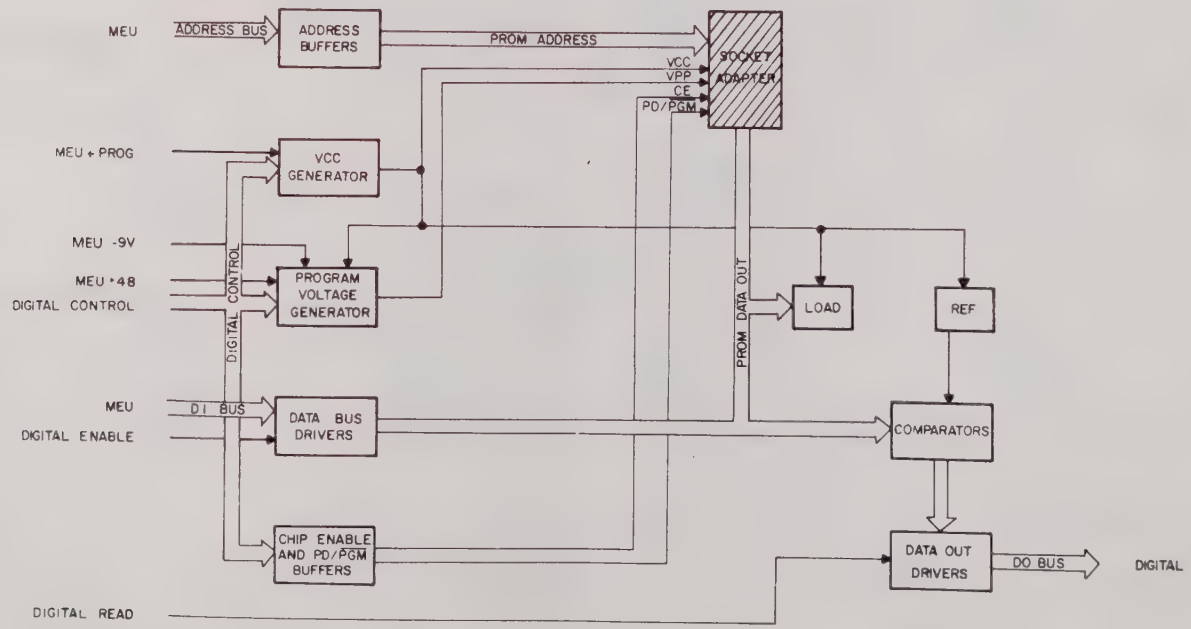


Figure 5-3. Block Diagram, 1512 Analog Card.

5.3.2 Vcc GENERATOR

The Vcc generator consists of a common emitter amplifier (Q1) controlled by a differential amplifier (Q2 and Q3). R6 provides a feedback path to the amplifier and serves as output voltage adjustment. The reference for the differential amplifier is determined by adjustable shunt regulator (Q10) and voltage divider action of R30, R37 and R19.

The generator output is held to zero volts when the programmer is in Stop. Fold-back current limiting is accomplished via Q6, Q14 and Q15. When excess Vcc current is drawn, Q14 turns on, turning on Q6 and Q15. Q6 holds the shunt regulator output (differential reference) to 0 volts, thereby holding Vcc to 0 volts. Q15 pulls Reset, Reset pulls Stop, and Stop holds the reference to 0 volts.

5.3.3 PROGRAM VOLTAGE GENERATOR (Vpp)

The Program Voltage Generator consists of transistors Q7 and Q12 driven by Q8 and Q9, respectively, and controlled by the differential amplifier Q4 and Q5. The output is push-pull with active pull-up and pull-down. The pull-up transistor is tied to either +Program or +48 by jumper JP5. The pull-down transistor is tied to -9V, or ground by jumper JP4.

The reference voltage for the differential amplifier is Vcc. R15 provides the negative feedback path. The output voltage is adjusted by R9 via JP3. R9 is jumpered to J1-5 by JP1. When J1-5 is low, the generator output sets at the value of Vcc. When J1-5 is high, the output can be adjusted above Vcc to a higher positive value. Foldback current limiting is present on both the pull-up and pull-down source. The output is held to 0 volts when the programmer is in Stop.

5.3.4 DATA BUS DRIVERS

Data from the DI Bus is presented to Gates U2, U3, U6 and U7. Outputs from these gates drive the PROM bits during program. During Read, Data Enable disables the gate outputs and data from the PROM is presented to the comparator.

5.3.5 COMPARATOR AND DATA OUT DRIVERS

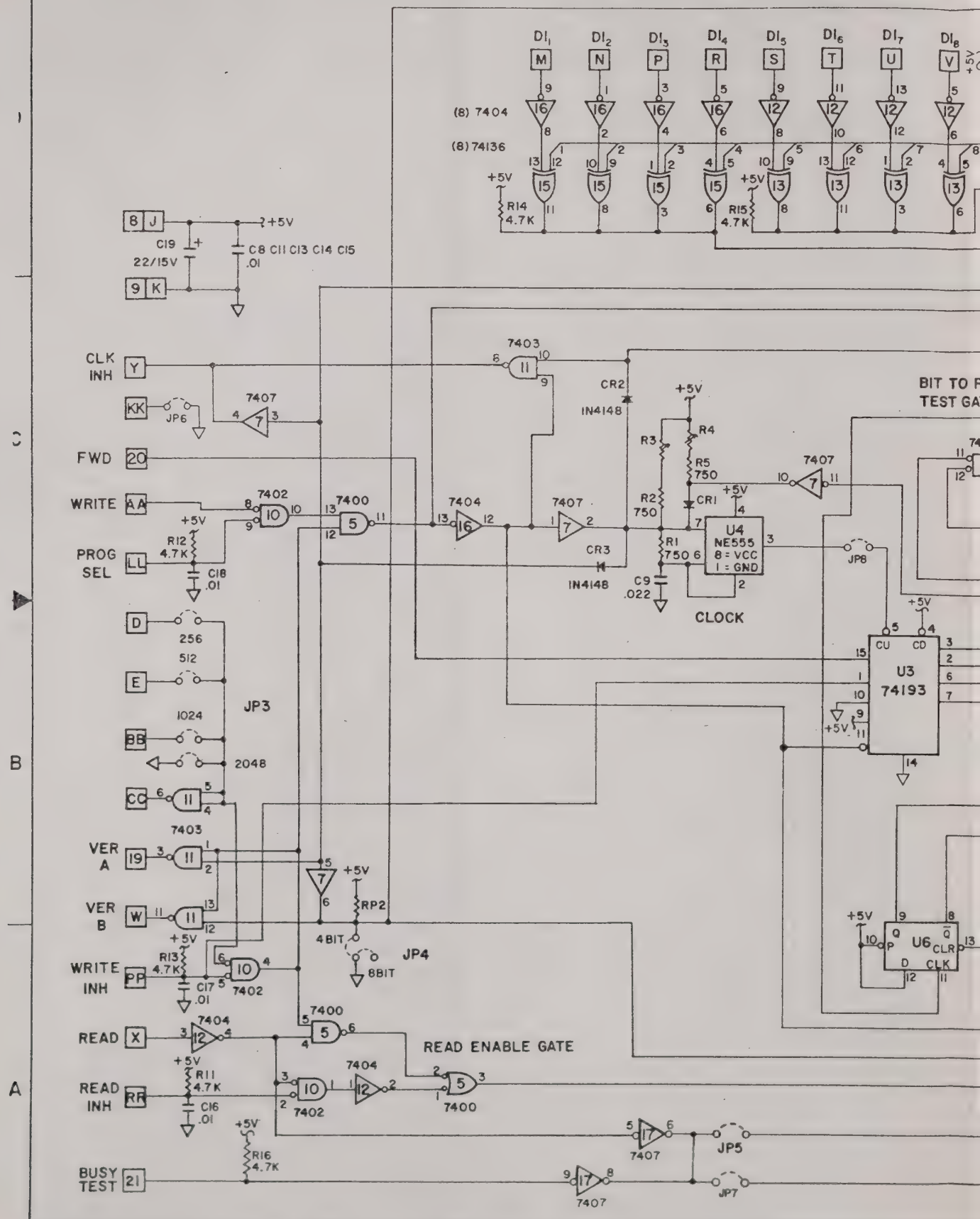
The comparator compares PROM bit data against the reference level. The reference for the comparator is determined by voltage divider R12 and R18. Comparator outputs are transferred to the DO Bus during Read by the data out drivers. This transfer allows the digital card to make a digital comparison of the transferred PROM output (DO Bus) to the programmer DI Bus.

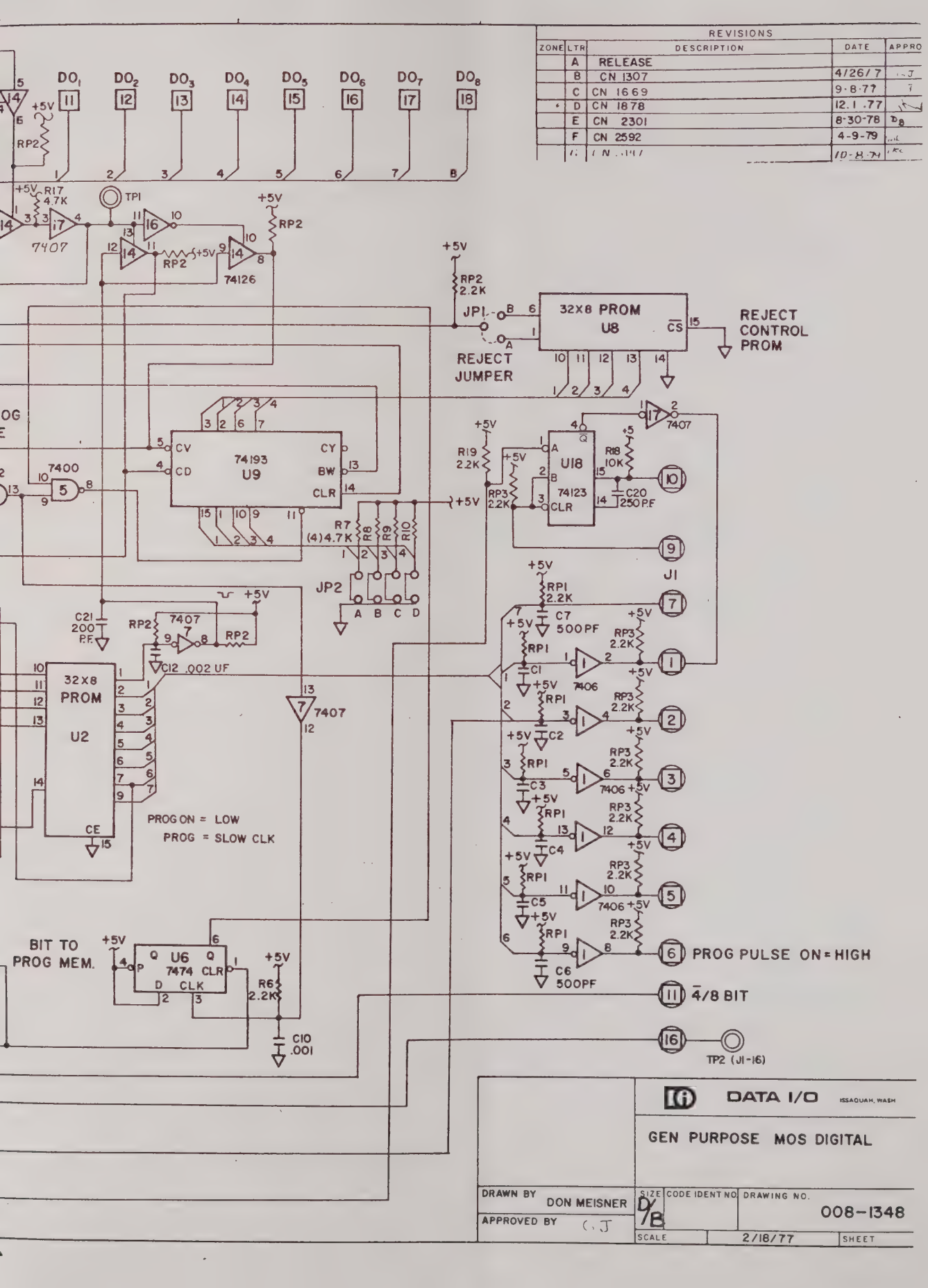
5.3.6 CHIP ENABLE AND PD/PGM BUFFERS

These buffers output the specified CE and PD/PGM voltage levels to the PROM during Program and Read. Their outputs are resistively pulled up to the Vcc supply.

SECTION 6
SCHEMATICS

008-1348	Gen. Purpose MOS Digital
008-1512	Single Voltage MOS Analog
008-1072	Calibration Adapter


DI1 DI2 DI3 DI4 DI5 DI6 DI7 DI8
M N P R S T U V
(8) 7404
(8) 74136
+5V
R14 4.7K
R15 4.7K
8 J
9 K
C19 22/15V
C8 C11 C13 C14 C15 .01
CLK INH
Y
KK
JP6
7407
FWD
20
WRITE
AA
7402
7400
7404
7403
PROG SEL
LL
R12 4.7K
C18 .01
CR2 IN4148
CR3 IN4148
R3
R4
R5 750
R2 750
R1 750
CR1
C9 .022
U4 NE555 8 = VCC 1 = GND
CLOCK
JP8
BIT TO F
TEST GA
U3 74193
CU CD
D
256
E
512
JP3
1024
BB
2048
CC
VER A
19
VER B
W
RP2
4 BIT
8 BIT
JP4
WRITE INH
PP
R13 4.7K
C17 .01
READ
X
READ INH
RR
R11 4.7K
C16 .01
READ ENABLE GATE
R16 4.7K
BUSY TEST
21
JP5
JP7
U6 CLR D CLK


REVISIONS
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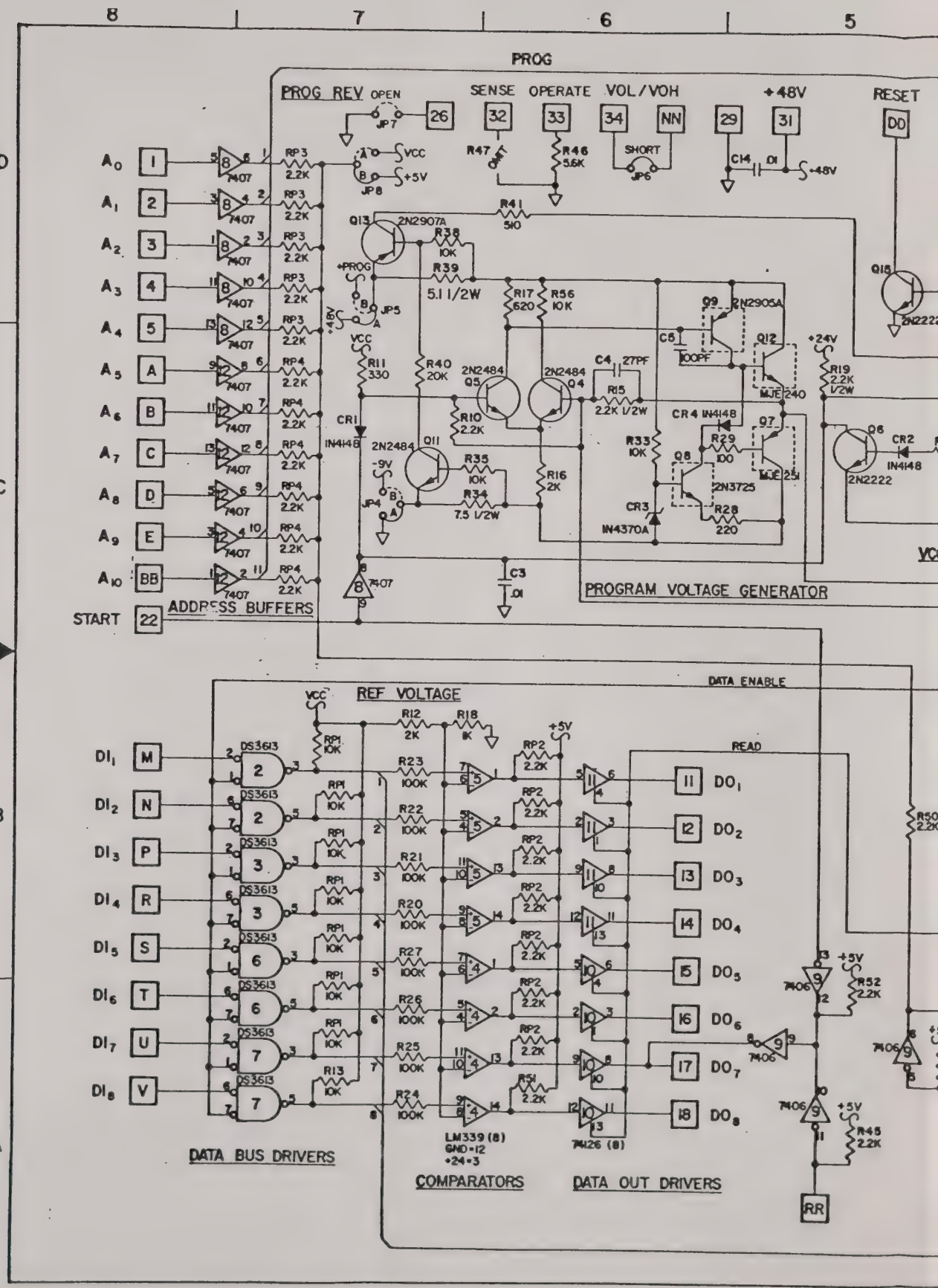
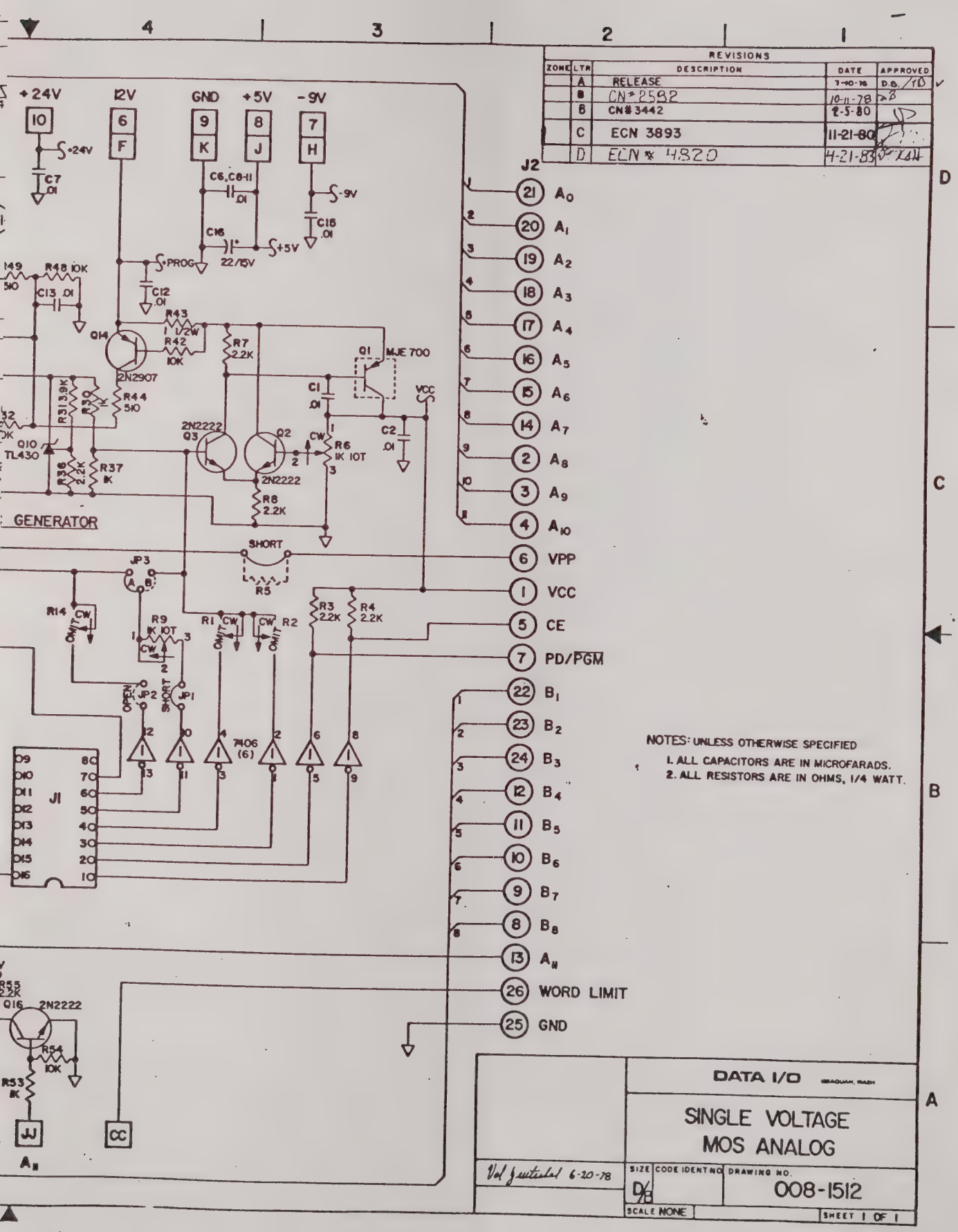
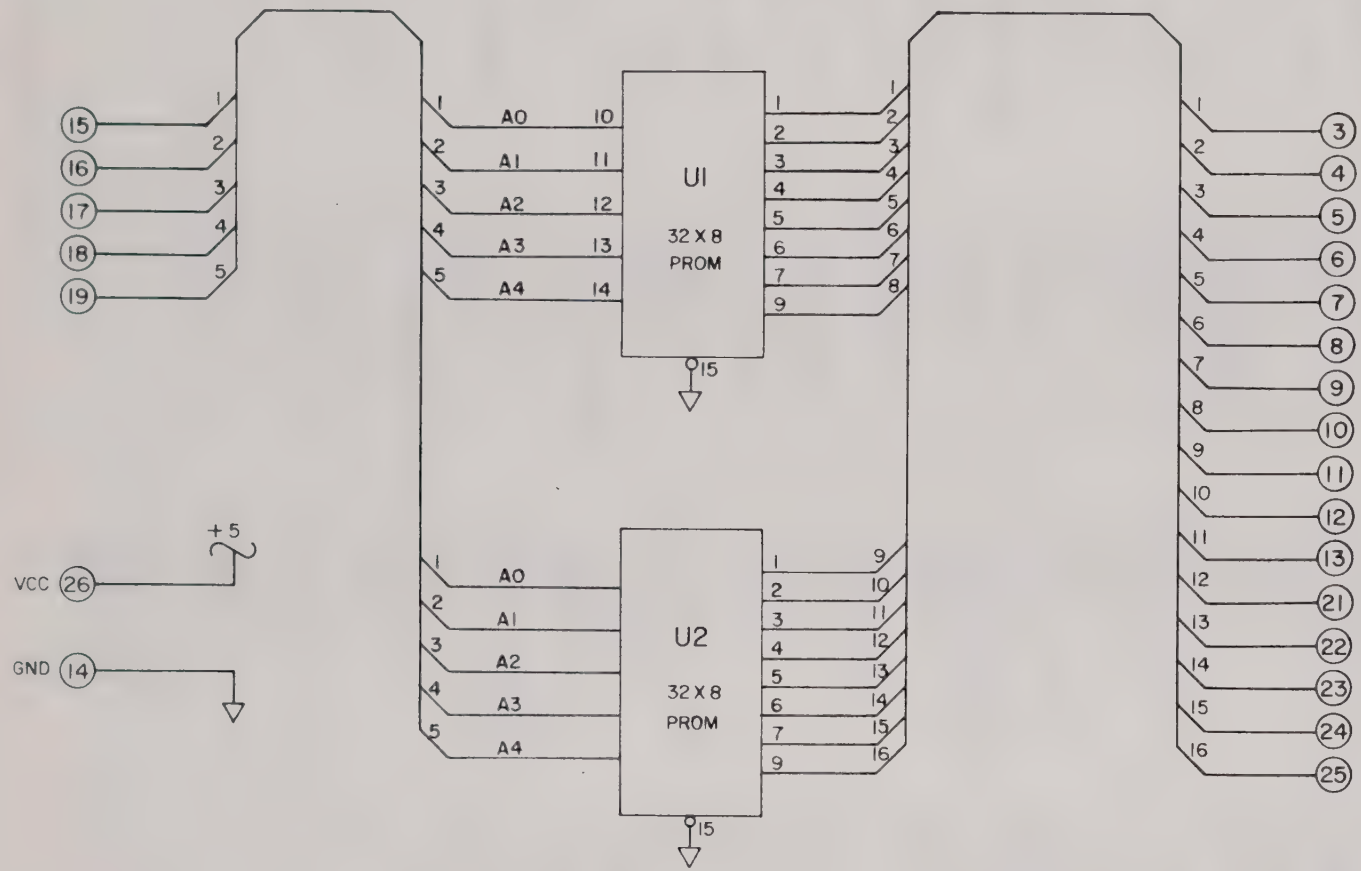
A RELEASE
B CN 1307 4/26/77
C CN 1669 9-8-77
D CN 1878 12.1.77
E CN 2301 8-30-78
F CN 2592 4-9-79
G CN 2947 10-8-79
DO1 DO2 DO3 DO4 DO5 DO6 DO7 DO8
+5V
RP2
R17 4.7K
TP1
7407
74126
RP2 2.2K
JP1
REJECT JUMPER
32X8 PROM U8
CS
REJECT CONTROL PROM
74193 U9
CV CD CY BW CLR
7400
R7 (4)4.7K
R8 R9 R10
JP2
A B C D
R19 2.2K
RP3 2.2K
U18 74123 CLR
R18 10K
C20 250 PF
J1
RP1 2.2K
C7 500 PF
C1 C2 C3 C4 C5 C6
7406
C21 200 PF
C12 .002 UF
32X8 PROM U2
CE
PROG ON = LOW
PROG = SLOW CLK
BIT TO PROG MEM.
U6 7474 CLR D CLK
R6 2.2K
C10 .001
PROG PULSE ON = HIGH
4/8 BIT
TP2 (J1-16)
DATA I/O ISSAQUAH, WASH
GEN PURPOSE MOS DIGITAL
DRAWN BY DON MEISNER
APPROVED BY C.J
SIZE D/B
CODE IDENT NO
DRAWING NO. 008-1348
SCALE
2/18/77
SHEET


8
7
6
5
D
C
B
A
PROG
PROG REV
OPEN
JP7
26
SENSE
32
OPERATE
33
VOL/VOH
34
NN
+48V
29
31
RESET
DD
SHORT
JP6
R47
R46
5.6K
C14
.01
-48V
VCC
+5V
JP8
R41
510
Q13
2N2907A
R38
10K
+PROG
R39
5.1 1/2W
JP5
R17
620
R56
10K
Q9
2N2905A
C5
100PF
Q12
MJE 240
+24V
R19
2.2K 1/2W
Q18
2N2222
VCC
R11
330
R40
20K
2N2484
Q5
2N2484
Q4
C4
27PF
R15
2.2K 1/2W
CR4 IN4148
R33
10K
Q7
R29
100
MJE 251
Q8
2N3725
R28
220
CR3
IN4370A
Q6
CR2
IN4148
2N2222
CR1
IN4148
R10
2.2K
2N2484
Q11
-9V
JP4
R35
10K
R34
7.5 1/2W
R16
2K
C3
.01
7407
PROGRAM VOLTAGE GENERATOR
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
START
1
2
3
4
5
A
B
C
D
E
BB
22
7407
RP3
2.2K
RP4
2.2K
ADDRESS BUFFERS
DATA ENABLE
REF VOLTAGE
VCC
R12
2K
R18
1K
+5V
READ
RP1
10K
RP2
2.2K
R23
100K
R22
100K
R21
100K
R20
100K
R27
100K
R26
100K
R25
100K
R24
100K
R13
10K
DS3613
DI1
DI2
DI3
DI4
DI5
DI6
DI7
DI8
M
N
P
R
S
T
U
V
DO1
DO2
DO3
DO4
DO5
DO6
DO7
DO8
11
12
13
14
15
16
17
18
LM339 (8)
GND=12
+24=3
74126 (8)
7406
R52
2.2K
R45
2.2K
RR
DATA BUS DRIVERS
COMPARATORS
DATA OUT DRIVERS


REVISIONS
ZONE LTR DESCRIPTION DATE APPROVED
A RELEASE 7-10-78 D.G.
B CN# 2582 10-11-78
B CN# 3442 2-5-80
C ECN 3893 11-21-80
D ECN # 4820 4-21-83
+24V
12V
GND
+5V
-9V
J2
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
VPP
VCC
CE
PD/PGM
B1
B2
B3
B4
B5
B6
B7
B8
A11
WORD LIMIT
GND
GENERATOR
SHORT
2N2907
2N2222
MJE 700
TL430
7406 (6)
J1
JJ
CC
NOTES: UNLESS OTHERWISE SPECIFIED
1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4 WATT.
DATA I/O
SINGLE VOLTAGE
MOS ANALOG
Val Jeutsdal 6-20-78
SIZE D/B
CODE IDENT NO
DRAWING NO. 008-1512
SCALE NONE
SHEET 1 OF 1

DATE	SYM	REVISION RECORD	DR	CK
11-13-75	A	RELEASE		



TOLERANCES EXCEPT AS NOTED	DATA I/O ISSAQUAH WASH		
DECIMAL .		SCALE	DRAWN BY G. ROPPE
			APPROVED BY
FRACTIONAL .	TITLE PLUG IN ADAPTER (UNIVERSAL CALIBRATOR)		
ANGULAR .	DATE 10-15-75	DRAWING NUMBER 008-1072	

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(713) 467-2192

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0321/183

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Telex 680356 SISTREL i

Sistrel SPA
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I-20092 Cinisello Balsamo (Mi)
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(2)6120129 or 6181893
Telex 334643 SISTREL i

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Telex 51037 SIMAC NL

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Telex Warfran AA82579

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Telex Warfran AA92908

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Telex Warfran AA22265

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Telex (011) 30869 CSEL-BR

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Cable - CADCOKIT - JOHOR BAHRU

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Guillermo Prieto 76-304
Col. San Rafael
Delegacion Cuahutemoc
06470-Mexico, D.F.
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546-29-55
Telex 017-75612 Mycome.

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Telex RS 37162 Answerback Geasin

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Telegrams Elbilem

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